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finds an explanation for Kant's ready-made functions. The symbols of mathematics and their values are human inventions, creations, and their conclusions cannot be canceled by any new facts. But the universe is not made of such numbers, angles etc., hence our logical truths (our creations) are incontestable. In this regard Helmholtz adheres to Kant while the New-Humists follow Hume. It is Hume who said: "Logical truths based on the principle of identity are irrefragable. No experience can add to or detract from these facts."

What are our analytical judgments? Nothing but those ideas which have been previously combined by synthesis and can be evolved from the combination. This means that they are ours by ancestral inheritance which is discovered as soon as we open the safe of logic. As long as we deal with logico-mathematical truths like Euclid's theorems our generalizing judgments remain valid.

WILLIAM MEYER.

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THEORY OF LIMITS.

In *The Monist* of July, 1905, in an article entitled "A Circular Polygon," Mr. Baker states that "the subject of limits as taught in elementary text-books is very crude and fogged with lack of perspective."

To this statement careful students will doubtless agree, but they will not likely accept all other conclusions expressed in the article.

If, as a variable assumes successive values *according to a given law*, it can be made to differ from a constant by as little as we please, but cannot be made equal to it, the constant is called the limit of the variable.

Of course, if the law of formation of the successive terms is altered, the limit may be altered, or may no longer exist. Thus in the examples given, in one case the horse gets out of the stable and in another case he does not.

But even this definition of a limit assumes that the constant has an existence independent of the variable. In many cases the limit is tacitly postulated and properties assigned by analogy. I believe this is a very common fallacy in current proofs concerning limits. Writers considering only variables having rational limits

are apt to overlook the limitations of their methods and to make hasty generalizations.

For example, we readily see that the limit of

$$1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots$$

is the known number 2. But consider the series

$$1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$$

By using similar methods can we say that "the sum is easily seen....to be exactly" some definite number, and that "there is no unattainable limit, no residual error"?

If a curve is a line no part of which is straight, there is *by definition* an insurmountable barrier to the derivation of properties of a curve from those of a straight line.

It would hardly do to define circles as lines of constant curvature, since the measurement of angles involves the use of circles, and also the definition would involve the length of curves in general—a problem not always satisfactorily dealt with in the case of the circle itself. Moreover, it is probably not until we study calculus that we can show that lines of constant curvatures do not include loci other than circles and straight lines.

A comparison of the properties of a variable figure with those of its limit is instructive, but we must not assume that the latter can be logically derived from the former. I do not believe we can derive the properties of a tangent to a circle from those of a secant, any more than we can derive them from those of a line without the circle and approaching indefinitely close to it.

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